



**Marked-Up Version of Amendments Submitted With**  
**Amendment; Response to the Final Office Action Mailed December 2, 2002**

**In The Claims:**

2424. (amended) A method of treating a coal formation in situ, comprising:  
providing heat from one or more heaters positioned in heater wells to at least a portion of  
the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation; and  
producing a mixture from the formation through one or more production wells, wherein  
the heating is controlled such that the mixture is produced from the formation as a vapor, and  
wherein at least about 7 heaters are disposed in the formation for each production well.

2430. (amended) The method of claim 2424, wherein ~~the one or more~~ at least one of the one or  
more heaters comprises a natural distributed combustors.

2433. (amended) The method of claim 2424, wherein providing heat from the one or more  
heaters to at least the portion of the formation comprises:

heating a selected volume ( $V$ ) of the coal formation from the one or more heaters,  
wherein the formation has an average heat capacity ( $C_v$ ), and wherein the heating pyrolyzes at  
least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day ( $P_{wr}$ ) provided to the selected volume is equal to or less than  
 $h * V * C_v * \rho_B$ , wherein  $\rho_B$  is formation bulk density, and wherein an average heating rate of the  
formation ( $h$ ) is about 10 °C/day.

2435. (amended) The method of claim 2424, wherein allowing the heat to transfer to the part of  
the formation ~~providing heat from the one or more heaters comprises heating~~ heats the part of the  
formation to increase ~~such that~~ a thermal conductivity of at least a portion of the part of the  
formation ~~is to~~ greater than about 0.5 W/(m °C).

2447. (amended) The method of claim 2424, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere of absolute pressure.

2457. (amended) The method of claim 2424, wherein allowing the heat to transfer ~~comprises~~ increasing increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2458. (amended) The method of claim 2424, wherein allowing the heat to transfer ~~comprises~~ substantially uniformly increasing increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5151. (amended) The method of claim 2424, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation ~~comprises to establish a~~ pyrolysis zone in the part of the formation.

5152. (amended) The method of claim 2424, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation ~~comprises to establish a~~ pyrolysis zone proximate to and/or surrounding at least one of the one or more heaters in the part of the formation.

5153. (amended) The method of claim 2424, wherein at least one of the one or more heaters is disposed in an open ~~wellbore~~ heater well.

5154. (amended) A method of treating a coal formation in situ, comprising:  
providing heat from one or more heaters positioned in heater wells to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation; and

producing a mixture from the formation through one or more production wells, wherein at least about 7 heaters are disposed in the formation for each production well.

5156. (amended) The method of claim 5154, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation ~~comprises to establish a~~ pyrolysis zone in the part of the formation.

5157. (amended) The method of claim 5154, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation ~~comprises to establish a~~ pyrolysis zone proximate to and/or surrounding at least one of the one or more heaters in the part of the formation.

5158. (amended) The method of claim 5154, wherein at least one of the one or more heaters is disposed in an open ~~wellbore~~ heater well.

5161. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises an electrical heaters.

5162. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises a surface burners.

5163. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises a flameless distributed combustors.

5164. (amended) The method of claim 5154, wherein at least one of the one or more heaters comprises a natural distributed combustors.

5167. (amended) The method of claim 5154, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume ( $V$ ) of the coal formation from the one or more heaters, wherein the formation has an average heat capacity ( $C_v$ ), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day ( $Pwr$ ) provided to the selected volume is equal to or less than  $h * V * C_v * \rho_B$ , wherein  $\rho_B$  is formation bulk density, and wherein an average heating rate of the formation ( $h$ ) is about 10 °C/day.

5169. (amended) The method of claim 5154, wherein allowing the heat to transfer to the part of the formation heats ~~providing heat from the one or more heaters comprises heating the part of the formation such that to increase~~ a thermal conductivity of at least a portion of the part of the formation ~~is to~~ greater than about 0.5 W/(m °C).

5181. (amended) The method of claim 5154, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere of absolute pressure.

5189. (amended) The method of claim 5154, further comprising:  
providing hydrogen ( $H_2$ ) to the ~~heated section~~ part of the formation to hydrogenate hydrocarbons within the ~~section~~ part of the formation; and  
heating a portion of the ~~section~~ part of the formation with heat from hydrogenation.

5191. (amended) The method of claim 5154, wherein allowing the heat to transfer ~~comprises increasing~~ increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

5192. (amended) The method of claim 5154, wherein allowing the heat to transfer ~~comprises substantially uniformly increasing~~ increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5196. (amended) A method of treating a coal formation in situ, comprising:  
providing heat from one or more heaters positioned in heater wells to at least a portion of the formation;  
allowing the heat to transfer from the one or more heaters to a part of the formation; and  
producing a mixture from the formation through one or more production wells, wherein the heating is controlled such that substantially all of the mixture is produced from the formation as a vapor, and wherein at least about 7 heaters are disposed in the formation for each production well.

5198. (amended) The method of claim 5196, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation ~~comprises to establish a~~ pyrolysis zone in the part of the formation.

5199. (amended) The method of claim 5196, wherein the heat is allowed to transfer from the one or more heaters to at least a portion of the part of the formation ~~comprises to establish a~~ pyrolysis zone proximate to and/or surrounding at least one of the one or more heaters in the part of the formation.

5200. (amended) The method of claim 5196, wherein at least one of the one or more heaters is disposed in an open ~~wellbore~~ heater well.

5201. (amended) The method of claim 5196, wherein at least one of the one or more ~~heat sources~~ heaters comprises a natural distributed combustors.

5204. (amended) The method of claim 5196, wherein allowing the heat to transfer ~~comprises~~ substantially uniformly increasing increases a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

5205. (amended) The method of claim 5196, wherein providing heat from the one or more heaters to at least the portion of the formation comprises:

heating a selected volume ( $V$ ) of the coal formation from the one or more heaters,  
wherein the formation has an average heat capacity ( $C_v$ ), and wherein the heating pyrolyzes at  
least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day ( $P_{wr}$ ) provided to the selected volume is equal to or less than  
 $h * V * C_v * \rho_B$ , wherein  $\rho_B$  is formation bulk density, and wherein heating rate ( $h$ ) is about 10  
°C/day.